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ORIGINAL ARTICLES

RECENT ADVANCES IN NEUROSURGERY, ESPECIALLY IN THE DIAGNOSIS AND TREATMENT OF BRAIN INJURIES.*

By William Sharpe, M.D.,

Professor of Neurosurgery, New York Polyclinic Hospital and Post-Graduate Medical School New York City.

During the past fifteen years a tremendous advance has been made in the diagnosis and treatment of neurosurgical conditions. The progress is due to three main causes: first, the pioneer work of men like Horsley, Krause and Von Eiselberg, and in this country of Keen and Hartley, and more recently, Cushing; second, better team-work between the neurosurgeon and neurologist, in that earlier diagnoses are more probable and thus the patient is less damaged by the time the operative treatment is advised and the surgeon himself understands the principles at least of neurology; and, third, an improved surgical technique, making possible the operative treatment of lesions of the central nervous system with a comparatively low mortality and the patient being in an improved condition after the operation.

The discouraging field of neurosurgery is the treatment of brain tumors (on account of their high percentage of malignancy—75%), brain abscess (the mortality of true brain abscess, a subcortical lesion, being almost 70%), and of the condition of internal hydrocephalus, a complete blockage of the ventricles (and not the usual condition of external hydrocephalus in which the early treatment is most encouraging), owing to the great difficulty and at present the impossibility of establishing early satisfactory drainage.

The encouraging field of neurosurgery consists of the ultimate treatment of persistent trifacial neuralgia by the severance of the posterior sensory root of the Gasserian ganglion with a mortality of less than 2%; the repair of the traumatic lesions of the brachial plexus and particularly those lesions occurring at the time of birth and thus named brachial birth palsies; surgical lesions of the spinal cord, as tumors (much less frequently malignant than those of the brain); traumatic conditions of the peripheral nerves; the milder conditions of external hydrocephalus; and lastly but most encouraging in the entire field of neurosurgery, the diagnosis and treatment of brain injuries with and without a fracture of the skull.

*Read before the Rhode Island Medical Society, March 5, 1925.

Brain Injuries in Adults.

1. *Acute.* The diagnosis and treatment of acute brain injuries have been retarded very much by the nomenclature "fracture" when it is now well known that the presence or not of a fracture of the skull is possibly the most unimportant part of the pathology of cranial injuries, both in the diagnosis and in the treatment to be afforded to the patient. (Naturally all depressed fractures of the vault should be elevated or removed for fear of future complications of cortical irritability, etc., and these depressed fractures will not be considered in this paper.) On the other hand, the most important pathology to be considered in brain injuries is the presence or not of an increased intracranial pressure, whether due to hemorrhage or to cerebral edema. If hemorrhage is present and of not sufficient amount to cover the convolutions themselves, then this fluid blood is found in the sulci about the supracortial veins. It is this blood, if not absorbed or satisfactorily drained, that permits an organized residue to form and thus to become an obstruction of varying degree to the future absorption of the cerebrospinal fluid. In the diagnosis of these conditions, the routine neurologic examinations are aided by careful ophthalmoscopic findings of the fundi and by the accurate estimation of the intracranial pressure by the method of lumbar puncture, as registered by the spinal mercurial manometer. But no patient should be subjected to prolonged examinations and tests, if that patient is in a condition of shock, for such examinations will

not aid the shock of the patient but rather prolong it, and our first consideration should be the general treatment of shock when present.

In the treatment of these acute brain injuries, I have had the opportunity to examine a large series of them (over 1000) and in this series the expectant treatment of quiet, ice helmet, warmth, shock measures, etc., was successful in almost two-thirds, 56%, of them. This expectant treatment was frequently aided by the spinal drainage of repeated lumbar punctures and these were the patients, in whom the increased intracranial pressure did not exceed twice the normal, the normal pressure being 6-8 mm. Hg., as registered by the spinal mercurial manometer. The use of concentrated solutions of magnesium sulphate to lessen the cerebral edema has rarely been effective in my own experience in these acute cases, but this method has proved of value in the chronic cerebral edemas associated with the condition of brain tumor, etc., in which the cerebral edema is rather an intracellular true edema than the "wet" edematous brain so frequently associated with injuries—in reality, an extracellular type of edema.

The operative treatment in this series was necessary in less than one-third (30%) of the cases and was advised only in those patients having an increased intracranial pressure of over twice the normal and in whom the expectant palliative method of treatment, together with repeated lumbar punctures of spinal drainage, failed to lower the pressure; the operation of choice was the subtemporal decompression and drainage. Those patients entering the hospital in a moribund state and dying within six hours after admission from shock, medullary edema (decompensation), other internal injuries, and for whom no operative treatment was naturally advised, numbered almost one-seventh (14%) in this series. The total mortality was 33% and, if we substract the 14% of moribund cases, the mortality is lowered to 19%. The operative mortality was 39% and naturally these patients operated upon were the more seriously injured, not only from the standpoint of recovery of life but from the standpoint of future normality. The operative treatment depended upon a marked increase of the intracranial pressure of more than twice the normal, whether this increased pressure was due to hemorrhage or to cerebral edema and these two factors form the most common and important pathology in brain injuries, it being rare (in only 6% of the cases) for a gross primary lesion of the brain, such as laceration and subcortical hemorrhage, to occur.

In the operative treatment of brain injuries, there are two periods in which *no* operation should be performed and it has been the neglect of this fundamental consideration that the operative treatment of selected cases of brain injuries had become almost discredited until within the past few years. The *first* period in which no operation should be performed is during the initial stage of shock, when the temperature is subnormal and the pulse and respiration rates are above 120 and 34, respectively, and the blood pressure below 100. To advise a cranial operation or even extensive prolonged examinations and tests upon these patients in the condition of severe shock merely lessens the chances of recovery, and if the patient does survive, then he recovers in spite of the additional shock of the examination and of the operation.

The *second* period during which no operation should be performed may be termed the terminal one of medullary edema (decompensation), characterized clinically by rapidly increasing pulse and respiration rates and rising temperature, but by a falling blood pressure. The patient may have been "doing nicely" for a period of several days and then he changes rapidly, so that the picture approximates the clinical syndrome as described above and then, since it is feared the patient will die, it is often thought advisable "to give him a chance"; but these patients all die, having the condition of medullary edema, whether operated upon or not, the operation merely hastening the exitus.

However, in the treatment of patients having brain injuries, their intracranial status can be most accurately estimated by repeated lumbar punctures and ophthalmoscopic examinations and in this manner the clinical signs of medullary compression, such as retarded pulse and respiration rates and a possible increasing blood pressure, can usually be anticipated and thus the dangerous condition of medullary edema be prevented by the rational treatment of early subtemporal decompression and cranial drainage in that small percentage of selected cases having a high intracranial pressure (less than one-third of all cases). The use of repeated lumbar punctures of the cisterna magna for the drainage of subtentorial hemorrhage with

marked signs of medullary compression may be of great value in selected cases.

2. *Chronic Brain Injuries in Adults.* It has been quite a common expression among the laity, that "once a person has had a fracture of the skull then that person is never the same again." To a large extent this impression is a correct one, at least it was so during the period of over ten years ago, when the attitude of the medical profession was concerned only with the recovery of life of the patient rather than the return to complete functional normality. In the absence of gross cerebral lesions of the brain as a cause of death in a large number of consecutive autopsies of patients dying from cranial injuries during the period of 1912 to 1916 in Bellevue Hospital, and the demonstration in these cases that the usual findings were "wet" edematous brains associated or not with varying degrees of hemorrhage in the sulci about the supracortical veins, it was most interesting to study the clinical records of four of the large hospitals in New York City of their patients having had cranial injuries during the decade of 1900 to 1910. The total mortality ranged from 46% to 64%, the operative mortality being as high as 87%, due to the operation being performed, when no operation should even be considered, during the period of initial shock and the terminal period of medullary edema, also the use of the more serious operation of osteo-plastic "flap" instead of the simple subtemporal decompression.

This study was made in the year 1912. Only 34% of the patients discharged as "well," "cured" and "improved" were located, but of these patients 67% were not well and were still suffering as the result of the cranial injury, the chief complaints and signs being headache, dizziness, early fatigue, change of personality to the depressed or to the irritable type and in a small number of them, convulsive seizures. It was rather surprising to find in a large percentage of these patients evidences of an increased intracranial pressure, as disclosed both by the ophthalmoscope and by the lumbar puncture and thus indicating the condition of "wet" edematous brains. At operation even at this late date after the injury or at autopsy, there was disclosed an edematous, "wet" brain under varying degrees of increased pressure and along the supracortical veins in the sulci was exposed a cloudy whitish new tissue formation—reported pathologically as being the organization-residue of a former layer of supracortical hemorrhage which could not be absorbed through the walls of the supracortical veins, through which almost 80% of the cerebrospinal fluid is normally excreted.

In the acute cases, when a supracortical hemorrhage is present, it forms a layer of varying thickness over the cortex in the extreme cases, but if the amount of hemorrhage is of less degree and not sufficient to cover the convolutions themselves, then it naturally collects in the depressed grooves of the sulci and about the supracortical veins, as is frequently exposed at operation or autopsy. If this blood can be entirely absorbed together with the cerebrospinal fluid through the walls of the supracortical veins, then no organization-residue forms, but if the amount of hemorrhage is more than can be absorbed by the main channels of excretion, then there remains a varying amount of blood in the sulci which eventually, within a period of days, clots and finally organizes to become new tissue of fibrous character and thus presenting the appearance of cloudy whitish new tissue formation, as exposed at later operation or at autopsy. It is this organization-residue which causes a partial blockage in the normal absorption of the cerebrospinal fluid, and thus the resulting "wet" edematous brain under varying degrees of increased intracranial pressure — the *organic* basis for many of the symptoms and signs occurring in patients having had a cranial injury, as headache, dizzy spells, early fatigue, change of personality and even convulsive seizures themselves, many of these symptoms and signs being due to intracranial pressure rather than to a gross cerebral lesion, such as lacerations, cortical hemorrhage, etc.

Posttraumatic Neurosis. In this connection of chronic brain injuries, the condition of posttraumatic neurosis is one that must always be considered, a functional condition to be differentiated from an organic one. In posttraumatic neuroses the emotional factor of fear and shock at the time of the injury is to be remembered, together with the constitutional make-up of the patient, whether neuro- and psychopathic or not; and also in a large percentage of these cases, the factor of hope of damages to be obtained, this latter complication being frequently an all absorbing one. If a legal suit is pending, it is rarely if ever possible to improve the condition of these functional cases by

any known methods of treatment; after the suit is settled, and especially if satisfactorily to the patient, these are the patients that improve very rapidly and usually within months or one year following the injury. However, no such patient should be considered as having a functional condition of neurosis without careful neurologic examinations having been made, and in each case competent ophthalmoscopic examinations and a lumbar puncture with an estimation of the pressure of the cerebrospinal fluid as registered by the spinal mercurial manometer, so that it is definitely ascertained that there is present no increase in the pressure of the cerebrospinal fluid. Otherwise the patient, having an increased intracranial pressure of chronic cerebral edema and thus an organic basis for the symptoms and signs, may be incorrectly diagnosed, for these patients having organic lesions do not "clear up" and improve following a mere satisfactory settlement of the legal suit. These organic lesions are ones now being frequently overlooked and neglected under the classification of posttraumatic neurosis.

Brain Injuries in Children.

(Under twelve years of age.)

1. *Acute.* The diagnosis and treatment of acute brain injuries in children are the same as in adults, except that the operative method of treatment to lower a marked increase of the intracranial pressure due to hemorrhage or to cerebral edema is much less frequent, owing to the fact that acute cerebral edema following cranial injuries in children occurs comparatively rarely. Apparently the intracranial vascular mechanism of the child adjusts itself much more rapidly and easily to the effects of cranial trauma, so that an increased amount of cerebrospinal fluid is either not secreted or, if secreted in large amounts, then the excess is absorbed without difficulty, so that the condition of acute cerebral edema only occurs in extreme cases. For this reason, the operative treatment of acute brain injuries in children has only been necessary in 16% of my patients, whereas in adults the operative treatment was advised in 30%. It may be stated also that children will stand the effects of brain injuries much better than adults and I believe this is also due to the less frequent occurrence of extensive cerebral edema in them.

2. *Chronic Brain Injuries in Children.* An observation of interest is the fact that the younger the child at the time of the acute brain injury and in those associated with an intracranial hemorrhage as indicated by the lumbar puncture having revealed bloody cerebrospinal fluid, the greater is the similarity of this chronic condition to the chronic condition of cerebral spastic paralysis following an intracranial hemorrhage at the time of birth with an increased intracranial pressure. That is, the symptoms and signs, especially the presence of spasticity of varying type and extent and the associated mental retardation of varying degree, are most similar in those patients the younger the age at which the intracranial lesion occurs. These are the ones having a definite increase of the intracranial pressure, as disclosed by the ophthalmoscope and the lumbar puncture, and at operation or at autopsy no gross lesion nor laceration of brain substance is exposed, but rather "wet" edematous brains under varying degrees of increased pressure and along the supracortical veins in the sulci is revealed a whitish cloudy new tissue formation, the organization-residue of a former layer of supracortical hemorrhage and thus the pathologic obstruction to the normal absorption of the cerebrospinal fluid through the walls of the supracortical veins. This pathology has been proven to be the same as that disclosed in the chronic brain injuries of adults in those selected cases having an increased intracranial pressure (chronic cerebral edema). In the younger patients and especially in those having had cranial injuries under the age of three years, the physical and mental impairments and retardation are undoubtedly due to the increased intracranial pressure having occurred before the pyramidal tracts and higher cortical centres had fully developed, and thus this prolonged increase of the intracranial pressure produced a clinical retardation, just as occurs following an intracranial hemorrhage at the time of birth and of such an amount that it cannot be entirely absorbed by the natural means of absorption.

Treatment. The use of thyroid and thymus therapy to lower the increased intracranial pressure of chronic cerebral edema by lessening the amount of cerebrospinal fluid secreted has been successful in only a small percentage of these patients (8%), so that the operative treatment of subtemporal decompression and cranial drainage in these selected

chronic cases, just as in the chronic cases of adults, was advised as the only means known of lowering the increased intracranial pressure. A definite improvement has resulted in the majority of these patients, as shown by a lessening of spasticity, an increased mental capability and a frequent diminution of the cortical irritability, but none of these chronic cases can be considered cured nor can they be conceived improved to the degree that they approximate normal individuals as if the intracranial hemorrhage had not occurred. This is true of all cases of chronic brain injuries, whether occurring at birth or later in life, and it strongly impresses one with the advisability of treating these conditions at the time of the acute lesion, when the blood is in fluid form, so that if the natural means of absorption are not sufficient to "take care of" all of the free blood, then repeated lumbar punctures of spinal drainage are to be urged and, if this method of drainage is not sufficient, then the subtemporal decompression of cranial drainage should be instituted early, in the hope that no organization-residue of unabsorbed hemorrhagic clot will form to produce future complications, both physically and mentally.

Chronic Brain Injuries Occurring at the Time of Birth.

1. *Chronic Brain Injuries Resulting from an Intracranial Hemorrhage at the Time of Birth.* It is most interesting to note in the literature that Mr. Little, of London, in 1843, in his first monograph upon "The Deformities of the Human Frame," stated that in his opinion the chronic condition of cerebral spastic paralysis occurring in children resulted from a lack of development and agenesis of the cerebral cortex or from a former meningitis (a destructive process), but that he had observed that a small percentage of the cases apparently were due to difficult labor. After a period of further study and especially of postmortem examinations of a large series of patients, it is impressive to note that in the second monograph of Mr. Little upon this subject in 1862 (19 years later), upon "The Influence of Abnormal Parturition, Difficult Labors, etc., upon the Mental and Physical Condition of the Child," he stated that in his opinion 75% of these cases of cerebral spastic paralysis resulted from an intracranial hemorrhage at the time of birth.

Yet it is most surprising to realize that in the literature upon this subject since this date and until within the last ten years, this second monograph of Mr. Little's has been practically overlooked, and the chronic condition of cerebral spastic paralysis has been considered as the so-called Little's Disease—due to a lack of development of cerebral tissues or to a destructive meningitic process and not to the usual cause, an intracranial hemorrhage at the time of birth. Mr. Little, however, and also subsequent observers did consider that the intracranial hemorrhage at the time of birth produced a primary gross lesion of cerebral tissue itself, and, therefore, an irreparable damage to the brain, so that when the diagnosis of Little's Disease was made, that diagnosis indicated and presupposed a hopeless condition. In this connection, however, it may be stated that the lack of cerebral development was most frequently attributed to some taint in the heredity, lues and to various developmental factors, all most discouraging to parents hopeful of normal children.

In 1913, I became interested in this chronic condition of cerebral spastic paralysis and, in taking careful histories of a large series of patients, at two of the orthopedic hospitals in New York City, and then by thorough neurologic examinations including the routine ophthalmoscopic and lumbar puncture tests, it was surprising to note that in a small percentage (12+%) of these patients there were evidences of an increased intracranial pressure—later demonstrated at operation or at autopsy to be due to a chronic cerebral edema. Occasionally, in a very small number of the older patients, the X-ray disclosed evidences of convolutional markings of the inner table of the vault, due to atrophy resulting from the prolonged increase of the intracranial pressure.

The history of these chronic patients having the condition of cerebral spastic paralysis is rather instructive. During the ten year period up to January, 1923, I have examined personally 5,192 children, and of this total number examined, 671 (12%) had an increased intracranial pressure as disclosed at lumbar puncture. The operative and postmortem findings have disclosed "wet" edematous brains under varying degrees of increased pressure, and along the supracortical veins in the

sulci was a whitish cloudy new-tissue formation, reported pathologically as being the organization-residue of a former layer of hemorrhage which had occurred most probably at the time of birth. Gross cerebral lesions of intra- and subcortical hemorrhagic cysts, old cerebral lacerations, etc., were disclosed in only 6+%.

The histories revealed the following data: 81% first children, 72% males, 95% full term babies, 90% difficult prolonged labors, 76% forceps used as a last resort, 17% breech deliveries; in 8% pituitrin had been used.

During the first week, the following observations had been made: 64% more drowsy and stuporous than normally, 23% refused to nurse, 78% lessened normal demand for food, 39% muscular twitchings, especially of orbital muscles and fingers, 17% general convulsive seizures occurred, 18% an icteroid appearance was present.

Within two weeks after birth, 61% were considered well and normal, if indeed anything abnormal had been suspected. Within one month after birth, 82% were considered normal.

Within the first year and usually around the seventh month after birth, 79% of the children were not developing as they normally should, such as holding up the head and later beginning to sit up, and at this time, within the first year, the development of spasticity of varying degree and type was usually observed. Later the child did not walk or learn to talk within the usual time and it was this development of a chronic condition in an apparently normal child that was most mysterious, to say the least, and its presence was ascribed to almost every possible cause. In this connection, I may state that the Wasserman test of the cerebrospinal fluid was positive in only one-half of 1% (1 in 200) of all the cases.

Treatment. The treatment of this chronic condition of cerebral spastic paralysis depends entirely upon the presence or not of an increased intracranial pressure: (a) Without a definite increase of the intracranial pressure and, therefore, the cerebral damage having already occurred, the treatment is limited to the various orthopedic measures and to mental training. To lessen the spasticity, numerous peripheral nerve operations have been devised, and recently even the severance of the paravertebral sympathetic ganglionic system. (b) With a definite increase of the intracranial pressure, if this pressure is not over twice the normal (normal 6-8 mm.), thyroid and thymus therapy may be tried in the hope that this mild increase of the intracranial pressure can be lowered to normal by lessening the amount of the cerebrospinal fluid secreted. However, if the increased intracranial pressure is over twice the normal (above 16 mm.), the operation of subtemporal decompression and drainage may be considered, in the hope that a sufficient amount of the blocked cerebrospinal fluid can be drained in this manner and thus a lowering of the increased intracranial pressure be effected with a resulting improvement of the child's condition, both physically and mentally.

The operative and post-mortem findings in these selected chronic cases of cerebral spastic paralysis have been practically the same as disclosed in the chronic cases of brain injuries which have occurred in young children and also in the chronic cases in adults, and the original pathology is apparently the same in these cases—a supracortical layer of hemorrhage of greater amount than can be normally absorbed through the walls of the supracortical veins; its collection in the sulci about the supracortical veins, and the subsequent formation of an organization-residue of the unabsorbed hemorrhagic clot and thus the resulting partial blockage in the normal excretion of the cerebrospinal fluid, producing "wet" edematous brains under varying degrees of increased pressure. The younger the child at the time of development of this increased intracranial pressure, and particularly, therefore, those cases due to an intracranial hemorrhage at the time of birth, the greater will be the physical and mental retardation and the more marked the condition of spastic paralysis. The older the patient is at the time of the intracranial hemorrhage, as in adults, the less marked are the gross physical and mental impairments, but the more marked are the subjective complaints, such as headache, dizziness, early fatigue and changes of personality and the greater are the emotional and psychic impairments.

The prognosis in the treatment of these chronic patients depends chiefly upon the age of the patient and the severity of the intracranial lesion. The younger the child at the time of the lowering of the increased intracranial pressure, the greater the improvement to be expected, but not one of these chronic patients can be expected to become

normal — the word "cure" cannot be used — as though the hemorrhage had never occurred, no matter what the treatment, because the treatment of these cases is always a late treatment. The ideal time for the treatment of brain injuries occurring at birth, just as in brain injuries of adults, is at the time of the acute condition, when the intracranial hemorrhage itself can be drained—in the adults after the period of initial shock has subsided and in the newborn within a period of one week.

2. *Acute Brain Injuries of the Newborn. Pathology:* For years, the acute condition of intracranial hemorrhage in the newborn has been a pathologic study of postmortem findings rather than their clinical recognition and, therefore, limited to a consideration of the gross lesions and of the extreme forms of intracranial hemorrhage of sufficient amount to cause the death of the baby. One hundred years ago, Denis, Billet and Cruveilheir wrote that one-third of the deaths in the newborn were due to intracranial hemorrhage. After Little described his findings in 1862, and Sarah McNutt in 1885, confirmed this opinion of the relationship of intracranial hemorrhage of the newborn and cerebral spastic paralysis, very little attention to this subject of intracranial hemorrhage in the newborn was given in the literature until the last decade when a greater interest has been aroused. Numerous investigators of the postmortem findings, particularly Warwick, Capon and others, have stated that at least 50% of the deaths in the newborn are due to a gross intracranial hemorrhage, resulting from a rupture of the tentorium, falx, large sinuses and of the supracortical tributaries of the longitudinal sinus, etc. And then the clinical observations of Sidbury, Brady, Green and others, have added to the clinical picture of a condition, the recognition of which, Huenekens states, is the most neglected phase of the care of the newborn and yet the most important one.

During the period of 1913 to January 1, 1923, I had the opportunity of examining in consultation and treating 46 newborn babies within the first two weeks, the diagnosis being a serious intracranial lesion, most probably hemorrhage following a difficult labor, with and without the use of instruments. The acute condition of these children was considered of such grave character that early death was feared and it was hoped that possibly a cranial operative procedure might offer the child a chance of recovery of life, at least. Lumbar puncture was performed on all but two (these two having died before the tests could be performed) and free blood, under varying degrees of increased pressure, was found in the cerebral spinal fluid of 87% of those patients tested during the first week after birth. During the second week, and especially later, the lumbar puncture becomes of increasingly less value as a diagnostic aid, the free blood usually coagulating within the first ten days. Repeated lumbar punctures for spinal drainage were used in four of the milder and earlier cases within the first week, in the hope that the intracranial hemorrhage could all be drained in this simple and safe manner, but in only two of them, after four and seven lumbar punctures respectively, every twelve hours, did the fluid become clear and of normal pressure.

This method of spinal drainage should be attempted in all but the very extreme cases of extensive intracranial hemorrhage, under high pressure, within the first week after birth. If the cerebrospinal fluid does not become clear or the pressure become normal and remain normal, then the cranial operation of subtemporal decompression and drainage should be considered. The operative and postmortem findings in 100% of these acute extreme cases disclosed subdural, supracortical and subarachnoid hemorrhage of varying degree. If not of sufficient amount to cover the convolutions, then the free blood was found in the sulci about the supracortical veins and always associated with a high degree of cerebral edema.

During the last three years, I became more and more impressed with the fact that these acute cases of extensive intracranial hemorrhage in the newborn, to the degree of producing profound unconsciousness, inability to nurse and even convulsive seizures, were almost the only ones being recognized by the obstetrician with any degree of certainty, the cases of milder degree and less extensive intracranial hemorrhage at time of birth not producing marked clinical signs of its presence, owing to the fact that the cerebral cortex at this early age is not highly developed—the newborn child being more of a spinal than a cerebral animal. Also, the histories of chronic cases of cerebral spastic paralysis were very suggestive, in that the large majority of them had been first-born, full-

term boys, delivered after a difficult labor, with and without the use of instruments, and in whom the clinical signs, even when observed, were often not more than a slight drowsiness, difficulty in nursing and an occasional twitching of the fingers and of the orbital muscles, and so often ascribed to "nothing at all"—the child having been subjected to a difficult labor, such a condition might be expected and then would "clear up."

Fortunately, in the mild cases of small hemorrhage frequently producing no definite clinical signs at all, the natural means of absorption were undoubtedly often sufficient to "take care of" the hemorrhage, so that no supracortical residue of organized new tissue formation of the layer of clot remained to block the normal absorption of the cerebrospinal fluid; these patients apparently became normal and remained so. Unfortunately, in those patients with more extensive hemorrhage and in whom the clinical signs during the first ten days after birth were usually noted, as indicated in this series of chronic cases (mild stupor, difficulty in nursing and an occasional muscular twitching), the condition apparently did "clear up" within the first two or three weeks but only temporarily so, for, after a period of several months of apparent normality, these children began to exhibit, within the first and second years of age, the definite signs of physical impairment and mental retardation—the typical condition of cerebral spastic paralysis. Naturally, this later development of a chronic condition in an apparently normal child was most puzzling and has been ascribed to numerous causes—lack of development, a former meningoencephalitis, syphilis, heredity and other causes.

Realizing that the ideal time for treatment of this traumatic condition of the newborn, just as in the cases of traumatic intracranial hemorrhage in adults with and without a fracture of the skull, is during the acute stage, at the time of birth during the first week, when the intracranial hemorrhage can be drained in fluid form and thus the danger of the later mental and physical impairments be lessened and even avoided, and not during the chronic stage (months and years later when the cerebral cortex may have been or has been permanently damaged in varying degree), and suspecting that this condition of intracranial hemorrhage of the newborn was occurring more frequently and much more commonly than had been conceived owing to the paucity and even lack of symptoms and signs at the time of birth, I obtained the permission in January, 1923, for performing a series of lumbar punctures on consecutive newborn children, at the City Hospital, Welfare Island, New York City, through the courtesy of Drs. Wilbur Ward and F. A. Dorman, on whose services the following observations have been recorded in 500 consecutive newborn babies. The lumbar punctures were performed by my associates, Doctors A. S. Maclaire and G. E. Espejo.

It was, indeed, surprising to find free blood in varying amounts in the cerebrospinal fluid at lumbar puncture, within 12 to 48 hours after birth, in 9 of the first series of 100 consecutive babies, in 13 of the second, in 10 of the third, and in 7 in the fourth and 6 in the fifth series of 100 babies; that is, in 45 or 9%. Two babies died in the first series of 100 cases—a ventricular hemorrhage in a seven months baby and a large supracortical hemorrhage in the other baby; one died in the fourth series—an apparently normal child following an apparently normal labor, with lumbar puncture revealing bloody cerebrospinal fluid; the child suddenly died 14 hours after birth from respiratory failure and the autopsy disclosed a large supracortical hemorrhage, and yet no clinical signs of its presence until the respiratory complications. The amount of blood in these cases varied from merely a reddish tinge of cerebrospinal fluid to that of almost pure blood. The test of lumbar puncture itself in these newborn babies was usually simpler than the routine procedure of taking the blood, the essentials being a well fixed spine in the horizontal position, an intramuscular needle instead of the large, lumbar puncture needle and naturally no anesthesia. In only 37 cases was the failure of a "dry tap" recorded. In each case, in which free blood was found in the cerebrospinal fluid and under varying degrees of increased pressure, as accurately recorded by the spinal mercurial manometer, an immediate second tap was made one interspace higher to confirm the presence of blood of the first test and the cerebrospinal fluid was slowly removed until the pressure descended to the lowest level within normal limits (4 mm.), and a third test 12 hours later was made to drain away still more of the free blood until the cerebrospinal fluid should become clear and under a pressure within normal limits (not over 8 mm.).

Clinical Signs.

Of the 45 cases having bloody and blood-tinged (straw colored) cerebrospinal fluid, only 29 had had signs indicative of a possible intracranial hemorrhage, such as drowsiness, refusal or difficulty in nursing and occasionally slight muscular twitchings of the orbital muscles or fingers; not one had a general convulsive seizure. Repeated lumbar punctures of spinal drainage permitted the cerebrospinal fluid to become clear and under normal pressure in 38 of the cases, as many as 9 tappings being necessary in one case. Probably in the milder cases the natural means of absorption would have sufficed to "take care of" all of the free blood, but repeated lumbar punctures of spinal drainage certainly assure it in the mild cases and aid the complete absorption in the more severe cases. The modified subtemporal decompression of cranial drainage is only indicated in the extreme cases and after spinal drainage has failed.

The danger of lumbar puncture was in evidence in one case only in which it was performed, the child being in an extreme condition of shock, and just as in adults having acute brain injuries, no extensive neurologic examinations should be performed and by no means a lumbar puncture—the patient being in the condition of shock and all such extensive and prolonged examinations merely increase the shock.

The labor was apparently normal in 14 cases; prolonged in 14 cases; low forceps in 3 cases and medium forceps in 7 cases, out of 41 forcep applications; the delivery was a breech in 7 cases. Not only is the traumatic rupture of the supracortical veins and of the tributaries of the longitudinal sinuses a chief factor in the causation of the intracranial hemorrhage of the newborn, but asphyxia due to prolonged labor, complications of the cord and its surrounding the neck, is also an apparent etiological factor.

Hemorrhagic disease of the newborn has been considered a chief and common cause of intracranial hemorrhage in the newborn and yet in this series of 45 cases of intracranial hemorrhage, in not one case was the coagulation time prolonged beyond the normal limits. These tests of the coagulability of the blood were taken with 24-48 hours after birth and it has been stated by several observers that the coagulation time of the blood only becomes lengthened after the third day of life. However, in the 45 cases of intracranial hemorrhage of the newborn, later examination of the blood within two weeks after birth did not disclose a lengthened coagulation time. Only one case in the entire series of 500 had a lengthened coagulation time and this child did not have blood in the cerebrospinal fluid.

Jaundice was associated with the condition of intracranial hemorrhage in 9 of the 45 cases, but in only three was the jaundice of the typical hepatic type, whereas, in the remaining six, it was merely an icteroid condition with no discoloration of the conjunctivae. Whether this latter is due to an hepatic disturbance or to hemolytic complications in the absorption of the intracranial hemorrhage, up to the present time there is apparently no recognized accurate means to differentiate hepatic from hemolytic jaundice.

At first, the intracranial pressure, as registered by the spinal mercurial manometer within 48 hours after birth, was uniformly around seven to eight millimeters of mercury and we were beginning to believe that that degree of pressure was the normal for the newborn, in spite of the earlier expectation that the intracranial pressure would be lower in the newborn than in the adults, on account of the open fontanelles and the greater normal elasticity of the dura in them. However, upon the discharge of these babies two weeks after birth—a final lumbar puncture revealed an intracranial pressure uniformly around three and four millimeters of mercury. Apparently there had been an acute cerebral edema of mild degree at the time of birth, either due to the moulding of the head or to Nature's protective mechanism of the brain, and this cerebral edema disappeared within ten days to two weeks after birth.

Impressions.

1. Intracranial hemorrhage of varying degree occurs much more frequently than has ever been conceived—cranial trauma and asphyxia during parturition being the chief factors; prolonged labor rather than the early application of low forceps is a common cause.

2. Clinical signs of the presence of intracranial hemorrhage in the newborn are often lacking and not recognized. Drowsiness, refusal to nurse and muscular twitches are most suggestive.

3. Early lumbar puncture, both as a diagnostic and as a therapeutic aid, is most essential in the rational treatment of the acute cases and in the preventive treatment of the possible future chronic cases of cerebral spastic paralysis with mental retardation.

20 West 50th Street.

DISCUSSION OF DR. SHARPE'S PAPER*.

By Dr. A. R. Newsam.

Dr. Sharpe's paper relative to the subject of intracranial hemorrhage in the newborn has been of especial interest to the obstetrician, pediatrician and neurologist.

The frequency of this condition is not properly estimated.

Of 163 new admissions to the Muscle Training Clinic of the Children's Hospital in Boston for one year, there were 51 cases of cerebral palsy, 37 of obstetrical paralysis, 23 with combined lesions, 9 with cerebral spasticity, 2 hydrocephalus, and 9 spinal cord injuries, making a total of 131 cases with neurological signs.

There must be a corresponding number of cases in Rhode Island, and yet to my knowledge no work is being done in any of the clinics in the study of these cases at the time of birth or during the first two weeks of life.

A large number of cases of intracranial hemorrhage of the newborn can be diagnosed during the first two weeks of life by clinical symptoms and signs, such as muscular twitchings, inability to nurse, convulsions, weakness of one or more extremities, bulging fontanelles and other neurological signs which Dr. Sharpe has mentioned. Spinal fluid findings, such as the presence of blood and of an increased intracranial pressure, may be of value as additional diagnostic aids in a number of these cases. Some observers also claim that there is a definite relation between intracranial hemorrhage and leucocytosis and this may be a valuable diagnostic aid.

There is still room, however, for considerable study of these conditions and of the various methods at our disposal for their diagnosis.

Quite a large number of these cases as Dr. Sharpe points out show signs and symptoms which are mild and fleeting, as, for example, slight twitchings, or even a slight weakness of one or more extremities. These cases are frequently disregarded entirely inasmuch as at the end of two or three weeks they appear as perfectly normal babies. It is, however, this type of case which comes to us later in life, because of inability to hold up its head or to walk and talk at the proper time or with spasticity or flaccidity of one or more extremities or with definite mental and physical impairment.

It is quite true that the diagnosis of intracranial hemorrhage in the newborn is not always dependent on the classical signs such as a bulging fontanelle, eye-ground changes, spinal fluid pressures and the presence of blood in the spinal fluid, inasmuch as numerous cases are seen, some with marked flaccidity, others with marked spasticity, in whom fontanelle and eye-ground changes are not constant or even frequent. Then again in some cases of evident brain injury, a clear tap is found on lumbar puncture, dependent entirely on the location of the hemorrhage. The spinal manometer must not be considered an infallible instrument for recording intracranial pressure in infants and children. Anyone who has attempted to take spinal manometer readings on infants and children will fully appreciate that there are a number of factors which modify the spinal fluid pressure and thus the spinal manometer readings—Cushing, Aird, Solomon and others have demonstrated the effects of coughing, deep breathing, crying, etc., on spinal fluid pressures.

In some cases we may also have a discontinuity of pressure—that is to say—our spinal fluid pressure may not agree with our intracranial pressure, due to the clotting of blood somewhere in the communication, producing spinal fluid pressure findings comparable to those found in tumors of the cord.

Dr. Sharpe's method of treating these acute cases by repeated lumbar puncture and drainage is rational therapy for a certain percentage of cases, but at the present time there are too many of the cases not diagnosed early enough to prevent clot and organization by lumbar puncture and drainage. Some of this difficulty could be eliminated by doing routine lumbar punctures on every newborn baby, but such a procedure is hardly advisable. Dr. Sharpe will agree that there are also a certain number of cases with supratentorial hemorrhages

*** Discussions of Dr. Sharpe's and Dr. McDonald's papers will be continued in the May issue. [Ed.]**

which cannot be drained by repeated lumbar punctures.

In spite of the many obstacles which we may encounter in the diagnosis of intracranial hemorrhage of the newborn, the majority of these cases should be diagnosed in the early and acute stage, i. e., during the first few days of life.

With an early diagnosis we can then hope for improved methods of treatment and thus avoid many of the unfortunate deformities and mental defects which we so frequently see in older children and adult life. To do this we must have complete co-operation between the obstetrician, the pediatrician and the neurologist.

ON THE DIAGNOSIS OF TUMORS OF THE SPINAL CORD.*

By Dr. Charles A. McDonald.

Providence, R. I.

During the last few years, much progress has been made in diagnosis and surgery of spinal cord tumors. Of the diagnostic methods which deserve special consideration, I refer to the increasing exactness in mapping out the disturbances in sensations: the greater use of the X-ray and additional knowledge of the Spinal Fluid. These methods of investigation have enhanced our knowledge and helped to bring relief to many. In my presentation today, I shall dwell upon those three points, placing the greatest emphasis upon the mechanics of the spinal fluid in cases of spinal cord tumors.

In a majority of cases of tumor of the spinal cord, a correct diagnosis and localization can be made on the history and neurological examination. An appropriate history in these cases must be taken with great detail—new symptoms must be sought for and the progress of all symptoms investigated. A neurological examination ought to be done by one familiar with the anatomy and physiology of the spinal cord and peripheral nerves, and by one who has patience and human endurance. Disturbances in the sensory component are hard to elicit and record. Lack of co-operation on the part of the patient; contradiction in the responses to the tests for pain, touch, temperature; the long time consumed in making the tests—are some of the obstacles in making a proper examination. These and other difficulties are so annoying that in many cases an extensive examination of the sensory component is neglected and much valuable information lost. For example, in the disease multiple sclerosis, there are so many motor disturbances to elicit that the sensory system receives scant consideration, and yet sensory disturbances are present in most cases of multiple sclerosis. To restate the foregoing, a painstaking history combined with an adequate neurological examination, including a thorough investigation of the sensory system, will suffice to make the diagnosis and localization of spinal cord tumors in most cases.

But there *are* cases in which a tumor of the cords is suspected and the localization doubtful. An exploratory laminectomy can be advised, but where? To make the diagnosis and to help to locate the tumor in these suspected cases, a spinal fluid examination, with special attention to the hydrodynamics will help. The spinal cord, soft and elastic, hanging in and stayed in a bed of spinal fluid, suffers displacements and distortions in adjusting to increasing pressure of an endothial new growth from without or from the expansion of an infiltrating glioma. On this account, symptoms and signs are complex and confusing, and additional methods of investigation are indicated to avoid the diagnosis of an incurable chronic disease.

To appreciate the importance and significance of spinal fluid changes, it is necessary to review for a few moments the circulation of the spinal fluid. The brain and spinal cord rest in a circulating water bed of spinal fluid. The spinal fluid is secreted into the ventricles of the brain and flows out of these ventricles through three small openings into a space known as the subarachnoid space —the spinal fluid in the subarachnoid space circulates up and around the cerebrum—circulates down and around the spinal cord and up and around the spinal cord to be absorbed. A harmless dye injected into the ventricle of the brain will appear in the spinal fluid in three minutes, and if the dye is injected into the lumbar cord, the dye will appear in the ventricles of the brain in a few minutes, showing that there is a

*Read before the Rhode Island Medical Society March 5, 1925.

circulation of the spinal fluid through the subarachnoid space surrounding the spinal cord. In an individual with normal circulation of the spinal fluid, fluid can be obtained by tapping the ventricles at the cisterna magna and in the lumbar region, and pressure estimates can be made. These will show that the pressure reading of the fluid at the cisterna is the same as at the lumbar region—that oscillations of the fluid level will vary with the pulse rate, the respiration rate, and with compression of the jugular veins. In a normal person, variations in spinal fluid pressures are equal at the site of a cisternal and lumbar tap. Tumors growing from the spinal menenges pressing upon the cord, and tumors of the cord itself encroaching upon the subarachnoid space, interfere with the circulation of the spinal fluid and cause variations in the pressure of the fluid. By lumbar puncture, with and without cisternal puncture, disturbances in pressure can be estimated and much help received to make the diagnosis of the presence of a spinal tumor. To make clearer, I shall quote a case with suspected cord tumor, in which the pressure estimates of the spinal fluid corroborated the diagnosis, and stimulated more painstaking neurological examination to locate the tumor.

In April, 1923, through the mercy of Dr. Ruggles, a case was admitted to Butler Hospital for additional study—the sent-in diagnosis was multiple sclerosis with personality changes. In brief, the patient had enjoyed good health up to April, 1922. The only noteworthy facts in her past history were some family discords, and a fall off a street car in 1919—she struck on her back and was in bed for one week under spiritual care. In 1921 patient complained of pain in her left leg which she called rheumatism—this pain lasted for about one year—almost constantly, yet she received no treatment excepting greater effort for mental purity. She got about and did her work and travelled some without much additional suffering until last July, when she required the aid of another's arm to walk around on account of weakness of this leg. Soon a pain came in the other leg, and an awkwardness in gait and an occasional tremble. For eight months the paralysis had become worse progressively, so that for two months before admission she could not walk and could not stand. She could not control her sphincters. A searching history revealed no more facts of importance excepting that in March, 1922, when she expressed a feeling of tightness around her right hip, and a feeling of band-like tightness extending transversely across body above the umbilicus. The examination gave no abnormalities of the head and of the cranial nerves. The motor control of the shoulder girdle and chest muscles was normal. The factors of defective motor control were limited to body and lower extremities. There was no paralysis, atrophy or tremor of a small group of muscles suggesting anterior horn disease. The reflex control was much impaired. The abdominal reflexes were absent. The knee jerks and achilles were very active—those of the right side greater than those of the left. There was a bilateral ankle clonus and bilateral Babinski, each more pronounced on the right. Both legs were weak, the right weaker, and the limitations of motion were in all directions. There was a marked hypertonicity of both legs, the right more than the left. There were no abnormal involuntary muscular movements. Tests for synergia and automatic-associated acts showed poor control. Sensory control of the arms and chest was normal, but of the lower body and legs there were abnormalities in sensation of the left leg: and of left side of body as high as the mid-dorsal area the sensibility to pain and touch was relatively diminished. On the right side of body and right leg, and on the left side of abdomen and over left leg touch was preserved, but sharper on the right. There were no other abnormalities excepting paralysis of both sphincters. The blood Wassermann and spinal fluid Wassermann were negative for syphilis, and X-ray showed nothing abnormal. These sensory findings varied in intensity—and to other observers varied in distribution. A spinal cord tumor was suspected by a member of the Hospital staff—but certainty and localization were doubtful. A second lumbar puncture was advised with special attention to the pressure readings, which were to be checked up at the same time by a cisternal reading. In other words, combined punctures were recommended. These were done. The cisternal needle registered 208 mm. of water. The lumbar needle, 65 mm. of water. After withdrawal of 5 cc. of fluid from the cisternal needle, the pressure fell only to 184: after withdrawal of 5 cc. from lumbar needle the pressure could not be measured as the fluid did not appear again in the manometer.

By Jugular compression, the cisternal pressure doubled itself: The lumbar pressure arose to 26 mm. only. These factors showed that between the two needles there was something that obstructed the spinal fluid circulation pressure. These findings convinced us that there was a tumor, and stimulated us to make a greater effort for localization. This we attacked. We made the localization at the sixes thoracic segment. Dr. Kingman, the visiting neuro-surgeon of Butler Hospital, operated and removed an endothelioma from the lateral aspect of the cord at the fifth dorsal vertebra. She made recovery. She regained control of the sphincters, developed motor control of her legs—and lost the sensory disturbances.

There are other cases in which a spinal cord tumor is suspected, but the history and neurological examination do not make the diagnosis certain, and do not definitely localize the suspected tumor. For cases of this type, a study of the spinal fluid pressure helps in proving the existence of the tumor, but does not aid in the localization. In cases of this type, the spinal fluid has another use. I am referring to the recent additional diagnostic technique of injecting a foreign substance into the spinal fluid and detecting its location by the X-Ray. For this we are indebted to the French School of Neurologists.

For example: an Italian-American of twenty-five entered a hospital complaining that two years previously he felt a sharp pain going down his right arm after an attack of coughing. He had enjoyed good health previously, and showed no evidence of previous accident or toxic organic disease. Three months previous to admission, his gait became staggering to a degree that one night a policeman thought he was intoxicated. The above pain continued, and the gait became worse. This pain and gait disturbance became more severe on emotional stress. For the pain in the arm he had had much physiotherapy, and for the staggering gait he had received four intravenous injections of a yellow fluid by a local medical doctor, but had never had a blood test. The examination in brief: of the cranial nerves, the only abnormality noted was a lateral nystagmus of each eye. The motor system showed defective control. The idiodynamic control showed no abnormalities. The reflexes showed many disturbances. Right biceps jerk was absent, the left present. Likewise the triceps jerk. The abdominal reflexes were absent. A cremasteric was not present. The knee jerks were very active, but the right was greater than the left. Babinski and Oppenheim signs were present in each leg. The tonus of the left arm was not increased, but both legs and right arm were hypertonic. There was a tendency to contractures of the Achilles. Skilled acts could be executed by the left hand, but by the right hand the spasticity of the arm interfered. There was a weakness in all motions of the right leg, and also of the left leg to a milder degree. There were no abnormal involuntary movements while at rest, but voluntary effort of the right arm and leg caused a clonus of this arm and leg. By the left arm, finger-nose test was well executed. By the right arm executed with awkwardness and difficulty. Heel-knee tests could not be done. There was a Romberg, with a tendency to fall to the right.

Sensory Control: From the toes to Pouparts ligaments there was numbness, and pain sense was poorly defined. Posteriorly this numbness and lessened pain sense extended up to the mid lumbar region. Temperature sense was poorly defined up to the umbilicus anteriorly, and posteriorly to just below the angle of the scapula. Splanchnics: the sphincters were intact and there was no evidence of any systemic disease. Blood Wassermann was negative. The urine showed no abnormalities, and the spinal fluid Wassermann was negative. The diagnosis of multiple sclerosis had been considered, and a tumor of the spinal cord was suspected. A lumbar puncture was ordered again with special attention to the pressure findings. As soon as the needle was inserted, the fluid dropped slowly, and as soon as it entered the test tube it coagulated. The fluid was slightly yellow. Compression of the jugulars did not increase the flow. and coughing did not increase the flow. After 5 cc. were withdrawn, no more fluid came. From these spinal fluid findings in correlation with the above examination the diagnosis was made of tumor of the spinal cord, probably located in the cervical region.

To make the location certain, 1 cc. of Lipiodol was injected into the cisterna magna. With the head at an angle of about 45 degrees, a radiograph was taken and a black shadow was seen in the region of the spinal cord at the fourth cervical vertebra. Eighteen hours later, a second X-ray

picture was taken showing the black area at the fourth cervical vertebra, and none below this vertebra—showing a complete block of the subarachnoid space. Dr. Mixter at the Massachusetts General Hospital saw the case and operated. He marked the skin over the location of the black shadow as seen in the X-ray, exposed the spinal cord, and removed a neuro fibroma clinging to the cord from the third to the sixth cervical segments. The patient made a satisfactory recovery. At Christmas time the patient reported that to and from his place of employment he wore a Thomas collar. Today he said he was well. He wears no longer the Thomas collar, and works all day without fatigue, pain, or weakness.

In my paper to you I have tried to make three points.

(1) By a careful history and thorough neurological examination, the diagnosis and localization of a spinal cord tumor can be made in most cases.

(2) In cases where the diagnosis of a spinal cord tumor is suspected, much help can be procured by a study of the mechanics of the spinal fluid.

(3) In rare cases, where more exact localization of a spinal cord tumor is demanded, by the injection of Lipiodol into the spinal fluid with a subsequent radiograph, exact localization can be made out.

Discussion.

Dr. Donley: After remarking upon the value of Dr. McDonald's paper as being a splendid example of the diagnostic precision which characterizes modern neurology, Dr. Donley went on to point out how remarkable has been the advance in our knowledge of nerve anatomy and pathology in the years since Gowers and Horsley reported the first successful diagnosis and removal of a spinal tumor in 1887. And he said that while this classical case had often been referred to in the literature he doubted whether many had experienced the pleasure which its perusal had afforded him, and so, by way of sharing his enjoyment with his colleagues, he would read an abstract of the original, as follows:

A Case of Tumor of Spinal Cord, Removal—Recovery. W. R. Gowers and Victor Horsley. Read June 12, 1888. From vol. 71 of the Trans. of the Royal Medical and Chirurgical Society of London. Medical history by Dr. Gowers.

Capt. G., aged 42, had good health until the year 1884. There was no history of syphilis. During 1883 and 1884 he endured much mental anxiety, and in the latter year he had a considerable mental shock—his wife was knocked down and run over in his presence and he was able to escape a similar fate only by suddenly throwing himself backwards. Soon afterwards he began to suffer from a dull pain across the lower part of the back which he thought was due to the strain of the accident. This pain passed away in the course of a few weeks and did not return. In June, 1884, he first felt a peculiar pain that was the most prominent symptom during the early part of his illness. It was localized in a spot beneath the lower part of the left scapula. This pain commenced suddenly one day while he was walking and was continuous and severe for about a month. It was increased by active exertion and by the jolting of a carriage. Repeated examination failed to find any cause for it. After a time it became less but was felt occasionally through the autumn and winter. By the spring it had all but ceased and he was asked to go out to China on business. Just before he went the pain was pronounced by a London physician to be due to intercostal neuralgia. On the way to China the pain returned and when Capt. G. reached his destination the pain was so intense and so increased by movement that he could scarcely walk.

At Shanghai a German doctor expressed the opinion that an aneurism was the cause of the pain. In September, 1886, the patient returned to England and the pain was so severe he was scarcely able to walk. He became extremely irritable and so marked was his mental change and his loss of self-control that the question was seriously raised whether he was quite sane and whether this mysterious pain was as severe as he described. In February and March, 1887, there came on a distinct loss of power in the legs, first in the left, then in the right. In the course of the next few months the weakness increased to complete loss of power, sensation became impaired, and the urine was retained in the bladder. On June 5, 1887, he was seen by Sir William Gowers. At that time there was absolute motor palsy of the legs, while cutaneous sensibility of all kinds was lost as high as the ensiform cartilage. At and just above this level,

that is, in the region of the 6th and 7th intercostal nerves, he complained of severe pain around the chest, much more severe on the left side than on the right, and increased to evident agony on any movement. The legs from time to time became rigid in extensor spasm and a clonus could be obtained with great readiness in the muscles of the calf and the front of the thigh. The paroxysms of spasm involved also the muscles of the abdomen. The bladder was distended and the urine that was drawn off contained pus. There was no irregularity of the vertebral column, nor could tenderness be discovered in any part of it. No trace of pulsation could be felt in the vicinity of the spinal column and no murmur could be heard on auscultation. The thoracic organs seemed healthy and both lungs were equally filled with air. The patient begged to have something done and the risks of any operation having been explained to him he was seen in consultation by Sir Victor Horsley, who concurred in Sir William Gower's opinion that there was mechanical compression of the spinal cord by a tumor.

On June 9, 1887, at 3:30 P. M., Sir Victor Horsley performed a laminectomy, discovered and removed a fibro-myxoma which was intra-dural, resting on and attached at its lower extremity to, the highest root of the left fourth dorsal nerve just where the posterior nerve-roots were gathered together in one trunk. The patient made a complete recovery of motor and sensory functions, lost all pain and returned to a condition of normal health and activity.

The operation of trephining the spine was known to surgery since it was first suggested by Lorenz Heister, the famous eighteenth century surgeon, whose General System of Surgery was the most popular book of its day in Germany. Speaking of the treatment of injuries of the spinal column, he says, "But to offer the patient no assistance because we despair would seem cruel and uncharitable, therefore we must try our skill though our attempts should be in vain; in order to which the surgeon must lay bare the fractured vertebrae with a scalpel and replace or else remove such fragments as injured the spinal marrow."

Since it was suggested, this operation, according to Erichsen's Surgery, had been performed about thirty times up to Horsley's day; but it was an operation which was strenuously opposed by surgeons because of the dangers attendant upon it, most particularly of course, septic infection. In 1881 Mr. Herbert Page, writing in Heath's Directory of Surgery and referring to the treatment of fractures of the spine, remarks, "The operation of trephining the spine, proposed many years ago and adopted several times, has made no progress in surgery nor is it likely to do so. * * * It is an operation not within the range of practical surgery."

It is interesting to read in the Medico-Chirurgical transactions, that when Sir Wm. Gowers and Sir Victor Horsley presented their paper, the first man to congratulate Horsley on his epoch-making operation was Mr. Herbert Page, who observed that Gowers and Horsley had opened a new era in the diagnosis and treatment of diseases of the spine.

Inconsulting text-books and articles, Horsley found reports of 57 cases of spinal tumor preceding his own patient's, and in every instance the outcome was a painful, disabling sickness terminating in death. In these cases 74% of the extra-dural growths and 83% of the intra-dural growths produced death from the direct effects of the tumor, so that speaking generally about 80% could have been entirely cured by operation or so relieved as to have been granted a euthanasia.

Writing in his Practic of Medicine in 1886, just a year before Gowers' and Horsley's case, Austin Flint speaks as follows: He is discussing compression of the cord. It is obvious, he says, that the symptomatology in different cases of compression of the cord must vary very much according to the cause, the seat, the amount of pressure, the nature and extent of the induced changes in the cord, etc. Diseases of the vertebrae, as well as fractures and dislocations, are determinable causes. The existence of an intraspinal tumor can hardly be determined with certainty, and, assuming that a tumor exists, to determine its character from the symptoms is impracticable.

In concluding, Dr. Donley said that while our knowledge is considerable, there are still vast continents of ignorance to be overcome, and no doubt our successors one hundred years hence will look upon our achievements much in the same spirit as we view the teachings of, let us say, the early nineteenth century.

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EDITORIALS

THE PHYSICIAN'S NEED OF STENOGRAPHY.

There can be no doubt that with the advance of knowledge in general, changes have taken place in medical learning. That efficiency,—that much abused word—is quite as desirable in medical education and practice as in business. It would take much writing to even enter the subject of the suitability of some of our present educational methods for the preparation of the mind for the study of medicine. It is to be assumed at the outset that every medical man is to be successful in the best sense of the term, that his will be a life of great usefulness and will make a fair living. It may also be assumed that an uncertain proportion of physicians will participate in some of the numerous intellectual activities collateral to his chosen profession. And it is also true that while no accomplishment is entirely superfluous those are of the greatest value which will assist the student in his efforts to appropriate from the enormous amount of material offered for his consideration that knowledge upon which his scientific life is to be built.

Conspicuous among the needs of every intellectual person and perhaps of everyone, is the need of typewriting and shorthand. It stands in the same relation to longhand that the tungsten lamp does to the candle, that the automobile holds with the chaise, or the steamship to the sailing vessel. There is hardly a department of life or learning where it may not be of use and with their assistance the mind may work with a freedom impossible with any other method. With this valuable acquirement one may earn a living almost anywhere in the world. The medical man may take notes in shorthand and make transcripts for future use in about a quarter of the time that would otherwise be needed.

If misfortune overtakes a member of a family it may be the means of tiding over a difficulty and a source of income. It furnishes the means of recording the thought more fully and completely for lecture or publication without the physical and time consuming embarrassment of ordinary penmanship. Although a storm of protest would result from broadcasting the thought that a knowledge of foreign languages, algebra and other well known "branches" was of less value than stenography that protest would come for the most part from those who teach these subjects and not from those who feel the need of practical working tools. A well known scientist once remarked that he would be glad to pawn what he knew of French, German, Latin, trigonometry and analytical geometry for typewriting and shorthand. Stenography is hard to learn, but it is no more difficult than any of the above. As to foreign languages almost all medical articles of real value are abstracted into English in more than one current publication and as to algebra we venture to claim that over 90% of physicians who have been in practice for over a quarter of a century have not had occasion to invoke the aid of this brain developing agent five times during that period if at all. Indeed it might be argued that everyone pursuing studies above high school grade would find stenography of immense help. Many students in technical schools are absurdly overworked and the pressure of their studies so great that they gorge rather than digest. The value of the typewriter to the clergy is well known and many feel that at least a part of their success is due to facility of recording. Of course it is absurd to suggest that any of the valued classics should be discarded but it should be urged that the typewriter is a veritable necessity of every day life and should be learned in addition to these studies and perhaps in place of some of them. We believe it to be one of the most useful accomplishments a professional man can acquire and that for mind forming, the development of mental alertness, for practical application and general usefulness it can hardly be surpassed.

The medical house officer will find shorthand of use in taking bedside notes and a typewritten history is sure to be appreciated by the supervising visiting man.

ARE THE STATE AND COUNTY MEDICAL SOCIETIES UP TO DATE?

It will be admitted that the county and state medical societies in Rhode Island are as a whole well run, the attendance averages well, the programs are usually interesting and the friendship and fellowship is cordial and well developed.

But, are we progressing along what might be called economic lines? We might take a lesson from medical societies in some of the western and southern states and note what is being accomplished in other centers for the advancement of medical science.

Several states now are employing full time lay secretaries who take over the business and correspondence of the state society, making the society more efficient than it has ever been before. These associations have found it possible to place more emphasis on public health instruction, postgraduate extension work, political activities in the way of bringing proper health and other medical legislation before state legislatures. In some states, the medical society has subscribed for many copies of *Hygeia* to be distributed in schools and health centers. Some societies have appointed committees to visit sick members and to render aid to their families when necessary.

All this means more work for somebody and possibly an increase in the annual dues but the gain to the Medical Society and to the public would be immeasurable.

Some of us feel that too much time is wasted in the transaction of routine business in the county society which could be better handled by the

standing committee or some similar organization. The members are often wearied before the scientific part of the program is reached and it is often necessary to shorten a paper or choke off a discussion in order to adjourn at a proper hour.

There are so many medical meetings nowadays, especially where hospital staffs are required to meet at least once a month, that it requires considerable energy for the average medical man to turn out for his county society meeting unless something of extreme interest presents itself on the program.

An eminent medical author has recently named four objectives for every medical society:

(1) Acquaintance — to bring about better understanding.

(2) Fellowship—to establish good will.

(3) Friendship—to encourage brotherhood.

(4) Education—to increase individual efficiency.

These objects will be attained only in a society which is a live wire, whose programs are interesting and snappy and whose officers are alive to their responsibilities and work for the best interests of the medical men and the public.

NEED OF TUBERCULOSIS DIVISION OF STATE BOARD OF HEALTH.

Rhode Island is essentially an industrial state, consequently there are thousands of people in Rhode Island employed in mills and factories, a type of work which necessitates a great deal of indoor confinement. From this fact it is easily seen that one of the menaces to our workers and, accordingly, to our industrial welfare, is from tuberculosis. There has been much work done in this State toward the care of people suffering with tuberculosis and we have a splendidly managed and equipped State Sanatorium, and much private endeavor has been put forth toward the detection of early cases, but we have been very remiss in an organized state effort toward prevention. A truly constructive step could and should be taken by the state in the addition of a department for the prevention and control of tuberculosis under our State Board of Health. We are all acquainted with the splendid efforts put forth for fighting the scourge of tuberculosis and have rejoiced over the striking results achieved, but we should not rest content until our state is thoroughly organized under a central bureau, which might properly come under the State Board of Health, for a constructive campaign of preventive work along the lines of tuberculosis. The medical profession may recognize and favor such a move, but this alone is not enough. It is, in such cases, necessary to present such facts as we have at hand before those representing us in the State Legislature in such a way that they can realize that this is not only needed from a humanitarian point of view, but that it would in the next ten years bring a rich reward in the form of lessening of disease and consequently lessening the cost of the care of sick persons.

SOCIETIES

Rhode Island Medical Society.

The quarterly meeting of the Rhode Island Medical Society was held Thursday, March 5, 1925, at 4 P. M., at the Medical Library, with the following program: 1. "Recent Advances in Neuro-Surgery, especially in Diagnosis and Treatment of Brain Injuries," by Dr. William Sharpe, New York City, Professor of Neuro-Surgery, New York Polyclinic Medical School. 2. "The Diagnosis of Tumors of the Spinal Cord," Dr. Charles A. McDonald, Providence, R. I.

The foregoing papers were discussed by the following: Drs. Donley, Kingman, Newsam, Ruggles and Sanborn. A collation was served.

Dr. J. W. Leech
Secretary

Providence Medical Association.

The annual meeting of the Providence Medical Association was called to order by the President, Dr. George W. Van Benschoten, Monday, January 5, 1925 at 9:10 P. M.

The records of the last meeting were read and approved.

The reports of the Secretary, Treasurer, Standing Committee and Reading Room Committee were read, accepted and ordered placed on file.

The President's annual address by Dr. George W. Van Benschoten dealt with the conduct of our meetings and some of the problems of the President in running them. He urged members to write and discuss papers, especially the younger mem-

bers who, in our excellent library, could thoroughly work up subjects. Speaking of the great clinical facilities in Providence, he brought up the question of Brown University again having a medical department and gave an interesting summary of the history of the previous one which existed from 1811 to 1827. He suggested that there would be advantages in again opening this department some day.

In accordance with Article 1, Section 6, of the By-Laws, the Standing Committee presented the following nominations for officers and committees for the year 1925:

For President: Albert H. Miller, M.D.

For Vice-President: Roland Hammond, M.D.

For Secretary: Peter Pineo Chase, M.D.

For Treasurer: Charles F. Deacon, M.D.

For Member of the Standing Committee for five years: George W. Van Benschoten, M.D. For Trustee of the Rhode Island Medical Library for one year: Charles O. Cooke, M.D. For Reading Room Committee: George S. Mathews, M.D., Elihu Wing, M.D., Herman C. Pitts, M.D.

For Delegates to the House of Delegates of the Rhode Island Medical Society: I. H. Noyes, M.D., P. T. Hill, M.D., W. P. Buffum, Jr., M.D., G. R. Barden, M.D., H. G. Partridge, M.D., A. H. Ruggles, M.D., A. M. Burgess, M.D., F. V. Hussey, M.D., W. F. Flanagin, M.D., M. B. Milan, M.D., H. B. Sanborn, M.D., L. C. Kingman, M.D., E. S. Cameron, M.D., W. H. Higgins, M.D., A. J. McLoughlin, M.D., P. P. Chase, M.D., C. W. Skelton, M.D.

For Councillor for two years: Henry J. Hoye, M.D.

The Secretary was instructed to cast one ballot for the entire list of officers. Dr. Miller was escorted to the chair by Drs. Boyd and Deacon. After a few remarks he appointed the following commmittees:

Collation: Paul C. Cook, Wilfred Pickles.

Publicity: Lucius C. Kingman, Charles A. McDonald, Joseph F. Hawkins.

The Standing Committee having approved the following applications for membership, George W. Bellano, M.D., and Edward A. Coppola, M.D., the Secretary was instructed to cast one ballot for their election.

It was voted that the dues for the following year be $5.00.

Dr. Frederick N. Brown made a plea that the papers read at the meetings of the Association be given to the RHODE ISLAND MEDICAL JOURNAL for publication.

It was voted to give $175.00 to the Rhode Island Medical Society Library for the purchase of magazines. It was voted to give $450.00 to the Rhode Island Medical Society for the use of the building.

After discussion by Drs. Deacon, Van Benschoten, Mathews and Partridge it was voted to give to the Rhode Island Medical Society Library $300.00 for the binding of magazines, this sum to include the unexpended balance from the amount subscribed last year.

Meeting adjourned at 10:05 P. M. Attendance, fifty. Collation was served.

Respectfully submitted

PETER PINEO CHASE

Secretary

The regular monthly meeting of the Providence Medical Association was called to order by the President, Dr. Albert H. Miller, Monday, March 2, 1925, at 8:45 P. M.

The records of the last meeting were read and approved.

A letter from Dr. Edward A. Coppola, who has just joined the Association, was read. A letter was read from the Bureau of Animal Industry, U. S. Department of Agriculture, regarding the conference on tuberculosis eradication to be held in Providence, June 16 and 17.

A letter from the N. E. Heart Association was also read telling of its aims and soliciting the interest of our members.

The Standing Committee having approved the applications of the following men they were elected to membership: Banice Feinberg, Tancredi G. Granata, Henry S. Joyce, Harry Soforenko, Henry L. C. Weyler.

The President appointed the following obituary committees:

For Dr. G. E. Buxton, C. H. Leonard, N. H. Gifford and the Secretary.

For J. B. A. Tanguay, W. R. White, A. W. Rounds and the Secretary.

The President read the announcement of the next meeting of the Rhode Island Medical Society and announced that all members of the Association were invited.

Dr. Louis I. Kramer read a paper on Congenital Myxedema, following the exhibition of a baby he had treated and a number of photos showing the change from a typical cretin to a bright and good looking child. In a clear and thorough manner he discussed the occurrence, etiology, symptomatology, differential diagnosis and treatment and reported a case.

Dr. Guy Wells read a paper on some phases of thyroid disease and their treatment, taking up myxedema and Graves' disease. He emphasized the value of the metabolic rate in diagnosing these conditions and gave a short discussion of calorimetry. After describing myxedema and its treatment he took up Graves' disease, the inter-relationships of the thyroid and other parts in its causation and the question of qualitative and quantitative changes in thyroid secretion; this was followed by the symptomatology, the differentiation from cardiac, psychopathic and tuberculous conditions and spoke briefly of treatment with special reference to the use of iodin. He then showed a lantern slide illustrating the lowering of the metabolic rate by the use of Lugols Solution.

The papers were discussed by Drs. Westcott, Wing, Mowry, Burgess, Kramer and Wells.

The meeting adjourned at 10:25 P. M. Attendance, 76. Collation was served.

Respectfully submitted

PETER PINEO CHASE
Secretary

RHODE ISLAND MEDICO-LEGAL SOCIETY.

The Regular Quarterly Meeting of the Society was held in the Medical Library, 106 Francis Street, Providence, on Thursday, January 29, 1925, at 5 P. M.

Paper: "Is the State of Rhode Island ready to pass a law authorizing the Eugenic Sterilization of the Mental Defective and Criminal?" By Henry A. Jones, M.D., of Cranston.

A light supper was served.

JACOB S. KELLEY, M. D.
Secretary.

PAWTUCKET MEDICAL ASSOCIATION.

The regular meeting of the Pawtucket Medical Association for January was held at the Jack-O' Lantern, January 15, 1925. President Duffee called the meeting to order at 9 P. M.

Minutes of the previous meeting were read and approved.

Dr. George K. Pratt of Boston presented an interesting paper entitled "The Relation Between Psychiatry and General Medicine." The paper included a talk on mental hygiene. Dr. John Donley opened the discussion, and it proved to be both interesting and instructive. A rising vote of thanks was given to Drs. Pratt and Donley.

Adjournment at 10:30 P. M. Attendance, 15. Collation followed.

R. T. HENRY, M.D.
Secretary

The regular monthly meeting of the Pawtucket Medical Association for February was held at the Jack-O' Lantern, Thursday, February 19, 1925.

President Duffee called the meeting to order at 9:10 P. M.

Minutes of previous meeting were read and approved.

Motion—Dr. S. Kenney—That the President be empowered to appoint a committee to arrange for annual banquet. Passed.

Motion—Expenses for banquet to be left to the discretion of the committee. Passed.

Motion—Dr. Henry—That President appoint a committee to nominate officers at the next meeting. Passed.

Committee appointed: Dinner Committee, Dr. Holt (Chairman), Drs. Sprague, Fenwick, Rothwell and Sweet. Nominating Committee, Drs. Sprague, Holt and Howe.

The speaker of the evening was Dr. Arthur T. Jones of Providence, who gave a talk on the subject of "Sub Phrenic Abscess," capably illustrated with X-ray films. After a short discussion the meeting adjourned at 10:15 P. M.

Collation followed.

R. T. HENRY, M.D.
Secretary